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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/050,334	01/15/2002	Vishnu K. Agarwal	MI22-1913	7861

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WELLS ST. JOHN ROBERTS GREGORY & MATKIN P.S.  
601 W. FIRST AVENUE  
SUITE 1300  
SPOKANE, WA 99201-3828

EXAMINER

HUYNH, YENNHU B

ART UNIT	PAPER NUMBER
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2813

DATE MAILED: 11/19/2002

7

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

10/050,334

Applicant(s)

AGARWAL ET AL.

Examiner

Yennhu B Huynh

Art Unit

2813

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 30 October 2002.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1-26 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-26 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

## Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

## Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 5.
- 4) ☐ Interview Summary (PTO-413) Paper No(s) \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_.

## DETAILED ACTION

This Office Action is in response to Amendment filed on 10/30/02

### *Election/Restrictions*

Claims 1-15 have been cancelled by Amendment filed on 1/15/02.

### *Claim Rejections - 35 USC § 103*

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 16-20 & 22-26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kitamura in view of Fukuzumi et al. (U.S. 2001/0023110A1).

Kitamura discloses a semiconductor device, which include:

Re. claim 16: an opening 101 in an insulating layer 48 over a substrate 41 the opening having sides and bottom; a first capacitor electrode 2A over the substrate 41, the electrode having an inner surface area 2C per unit area and outer surface area 2A per unit area (fig. 2E, p. 4, [0052]), that are both greater than an outer surface area per unit area of the substrate (p. 2, [0026]). Kitamura does not disclose clearly the both inner surface area per unit area and outer surface area per unit area that are greater than an outer surface area, but indicate that the grains grown on the inner surface area

and do not grow to outer of the substrate area because the outer layer serves as a stopper layer to the grains (p. 2, [0026]); therefore the area of both inner area 2C and outer area 2A are greater than the outer area of the substrate; forming a capacitor dielectric layer 11A over the first electrode, and a second capacitor electrode 3A over the dielectric layer.

Re. claims 17 & 25: wherein a bottom electrode comprises TiN layer (col.3, [0046]).

Re. claims 18 -20, 23 & 24: comprising rugged undoped polysilicon over the substrate (col. 4, [0051]) and comprises spaced apart grains (fig. 2B-2E).

Re. claim 26: wherein the dielectric layer comprises Ta<sub>2</sub>O<sub>5</sub> (col.4, [0057]).

However, Kitamura discloses the HSG layer over the sides of the opening but not over the bottom (cl.22). Kitamura also fails to disclose a capacitor dielectric layer formed of ZrO<sub>2</sub>, WO<sub>3</sub>, Al<sub>2</sub>O<sub>3</sub>, HfO<sub>2</sub>, BST or ST material (cl.26).

Fukuzumi et al. in related art disclose:

-Re. claims 21 & 22: an opening 5 in an insulating layer 4 over a substrate 2, the opening having sides and a bottom; a HSG layer over the sides of the opening but not over the bottom; a first capacitor electrode layer 7 on the polysilicon, which has a rugged outer surface with an outer surface area per unit area greater than an outer surface of the substrate underlying the first electrode (fig.2-6, col. 4,5, [0079]).

-Re. claim 26: wherein the dielectric layer comprises of Ta<sub>2</sub>O<sub>5</sub>, ZrO<sub>2</sub>, BST or ST (col.5, [0080, 0084, 0151]).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify Kitamura 's process from Fukuzumi et al. 's process by forming the HSG over the sides of opening to increase the electrode area and obtain a large capacitance in a small cell area of capacitor structure, and by including the high dielectric material to prevent a leakage current by when structure processed at a high temperature.

With respect to claim 21 the thickness of the outer surface area of the first electrode as compared to the substrate outer surface area is considered to involve routine optimization and therefore while has been held to be within the level of ordinary skill in the art, As noted *In re Aller* 105 USPQ233, 255 (CCPA 1955), the selection of reaction parameters such as temperature and concentration would have been obvious.

"Normally, it is to expected that a change in temperature, or in range, concentration, cycles, thickness, would be an unpatentable modification. Under some circumstance, however, changes such as these may be impart patentability to a process if the particular ranges claimed produce a new and unexpected result which is different in kind and not merely degree from the results of the prior art ... such ranges are termed "critical ranges and the applicant has the burden of proving such criticality ... More particularly, where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation." *In re Aller* 105 USPQ233, 255 (CCPA 1955). See also *In re Waite* 77 USPQ 586 (CCPA 1948); *In re Scherl* 70 USPQ 204 (CCPA 1946); *In re Irmischer* 66 USPQ 314 (CCPA

1945); In re Norman 66 USPQ 308 USPQ 308 (CCPA 1945); In re Swenson 56 USPQ 372 (CPA 1942); In re Sola 25 USPQ 433 (CCPA 1935); In re Dreyfus 24 USPQ 52 (CCPA 1934).

### ***Response to Arguments***

Applicant's arguments filed 10/30/02 have been fully considered but they are not persuasive.

The Applicant argues that:

Kitamura does not disclose:

- 1)-the doped outer layer 2A may be undoped (p.6)
- 2)-that both surfaces of the electrode have surface areas per unit area that are greater than the surface area per unit area of a substrate surface (ps.6&7)
- 3)-the inner and outer surface of electrode layer is not defined (p.7)
- 4)-does not suggest an enhancement layer (p.8)

The Applicant further argues that:

Fukuzumi does not disclose:

- 1)-a HSG layer formed over the bottom of the opening (p.9)

Applicant's attention is respectfully directed to:

A). Kitamura :

- 1)-the doped outer layer 2A may be undoped (p.4, [0051, line 6])

2)-it is well known in the art to increase a dimension of the surface area of a capacitor. However, Kitamura also disclose teach the electrode surface area are larger than the surface of the substrate area (p.2, [0026])

3)- defining clearly the inner and outer surface of lower electrode layer (p.2, [0026]). In addition, Fukuzumi et al. 's (US 2001/0023110 A1) also disclose defining the lower electrode layer 7 including inner and outer surface of (p.4, [0079, 0152]).

4)- examiner agrees that Kitamura does not disclose the enhancement layer. However, Fukuzumi et al. (p.4, [0077]) disclose forming an enhancement layer 6 formed over the substrate and a first capacitor electrode 7 over the enhancement layer

B). Fukuzumi et al. :

1). disclose a HSG layer 52 formed over an enhancement layer 51 and the bottom of the structure (figs. 31-34, p.8&9, [0136])

### ***Conclusion***

**THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of


the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Yennhu B. Huynh whose telephone number is 703-308-6110. The examiner can normally be reached on M-F 8.30AM-7.00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead, Jr., can be reached 703-308-4940. The fax phone numbers for the organization where this application or proceeding is assigned are 703-308-7722 for regular communications and 703-308-7724 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

YNBH,  
11/7/02

  
CARL WHITEHEAD, JR.  
SUPERVISORY PATENT EXAMINER  
TECHNOLOGY CENTER 2800